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ABSTRACT

The development of and relationship between early language, symbolic play, sensorimotor skills, and social development were examined in a longitudinal study conducted in Japan with two young autistic males who were observed from the approximate ages of 2 to 4 years in clinic, day care, and home settings. One child acquired speech; the other did not. Both boys successfully completed specific sensorimotor tasks (e.g., nesting containers inside one another), and it was concluded that these skills are not related to early language development. Temporal correspondences between early language development and symbolic play were found for one subject. The emergence of nominal words corresponded to the onset of substitution play, and word-chains occurred simultaneously with the onset of combinatorial symbolic play. Immediate and delayed echolalia were not found to be related to symbolic play. Both boys were deficient in symbolic functions which included language, symbolic play, and drawing, but when one boy attached to a particular adult and began social interactions, development in these three areas was noted. (Author/JW)

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The Relationship between Early Language, Cognitive and Social Development through a Longitudinal Study of Autistic Children

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Abstract: The relationship between early language, symbolic play, sensorimotor skills and social development was examined through a longitudinal study of two autistic boys. One boy was observed from the age of two years to four years and five months old, and another boy was observed from the age of one year and eight months to four years and one month old.

One boy acquired speech, but the other boy did not.

Temporal correspondences between early language development and symbolic play were found in the case of one boy. The emergence of nominal words corresponded to the onset of substitution play, and word-chains co-occured with the onset of combinatorial symbolic play. Concerning sesorimotor skills both boys passed VI stage of means-ends and causality, and performed combinatorial tasks well even when they had few words. They were deficient in drawing.

Both autistic boys were deficient in symbolic functions which included language, symbolic play and drawing, but when one boy attached to a particular adult and began social interactions, the development of language, symbolic play and drawing was observed.

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This study suggests that symbolic abilities are learned in the context of interaction with others.

Introduction

A number of mental operations have been suggested as being related to language development. Moor & Meltzoff (1978) proposed certain requirements that must be met in order for an infant to use words meaningfully. These are symbolic representation which is linked to imitative development, the capacity of object permanence, and the development of spatial, causal and temporal concepts. Bates, Benigni, Bretherton, Camaioni & Volterra (1979) showed that the cognitive measures which did predict both language and gesture were means-ends, imitation and the various aspects of play, from a correlational study of infants about 9-13 months-old .

The absence of certain cognitive skills may explain why some children fail to acquire language.

According to Nishimura, Mizuno & Wakabayashi (1980a), the percentage of non-speaking autistic children ranges from 28%

to 49%, and is higher than the percentage of non-speaking mentally retarded children. They speculated that disorders of speech and language in autistic children are closely connected with the nature of the autistic disturbance. Autistic children manifest a specific cognitive defect involving language impairment (Rutter, 1978). Curcio (1978) reported 12 mute children, diagnosed autistic, performed most poorly on the imitation scale, with 9 of 12 performing below Piaget's fifth sensorimotor stage. In contrast, performance was highest on the object permanence scale with all performing above Piaget's fifth sensorimotor stage. Nishimura et. al. (1980b) reported the performance of 10 non-speaking autistic children was highest on means-ends scale and lowest on the gestural imitation scale. Development across domains in autistic children appears to be more uneven than that observed in both mentally retarded and normal children.

Sigman & Ungerer (1984) showed there were no differences in sensorimotor skills between autistic, mentally retarded and normal groups matched on mental age except that the autistic children were deficient in the capacity to imitate

gestures and vocalizations. But they found autistic children showed less diverse functional play, particularly directed toward dolls, and less symbolic play both spontaneously and after cueing. Autistic children had specific deficits in imitation and symbolic abilities. Rutter (1978) conceives of autism as a specific disorder involving a primary disturbance of symbolic capacity. Other researchers point out the disturbance of symbolic play and language development in autistic children (Riguet, Taylor, Benaroya & Klein, 1981; Shinagawa, 1985; Wing, Gould, Yeates & Brierley, 1977; Wulff, 1985). The young autistic child is specifically delayed in development and use of verbal and gestural symbols, tasks that are both cognitive and social in nature. The ability to form symbols is clearly a cognitive skills, but the meaning and communicative function of symbols are learned in the context of interaction with others (Ungerer & Signan, 1987).

The purposes of the present study were (1) to examine the development of verbal and gestural behavior, symbolic play and sensorimotor skills through a longitudinal study of two autistic children, (2) to clarify the relationship

between early language, symbolic play, sensorimotor skills, and social development.

Method

Subjects

The subjects were two Japanese boys (H.O., N.N.).

H.O. was the second born son of a middle class family of Matsue City. H.O. took developmental screening test at 1;11 (one year and eleven months old) in the local public health center. He was diagnosed autistic by a pediatric neurologist and a psychologist because his interpersonal relationship was very poor, he did not point, did not use words and had no face-to-face interactions. He was cared for by his mother. His mother was aware that his language development was slow at 1;10 but was not worried about it, because that of his elder brother had been slow. The developmental history of H.O. revealed no special event during pregnancy and birth. He began to walk at 11 months old. He was referred by a public health nurse to our clinic at 2;0.

He visited our clinic once a month for the first four months. He entered the day care center for handicapped children at 2;4, where he was forced to attend the structured setting in the morning and played freely in the afternoon. He did not want to go to the day care center till 3;4. From 3;3 a student teacher tried to interact with him twice a week at the day care center. After his entrance of the day care center, he visited our clinic several times for evaluation.

N.N. was the first born son of a middle class family of Matsue City. He had poor vocalization, communication and avoid face-to-face interactions at 1;4. He was cared for by a strict grand-mother. The developmental history of N.N. reveals no special event during pregnancy and birth. He began to walk at one year old and uttered manma at 11 months old. The author visited his home once a month till he was 2;1. Mother left work and cared for him from 1;10 to 1;11. He entered the regular nursery school at 2;0 where he was forced to attend the structured setting and sometimes didn't want to go there. At 3;11 he moved another regular nursery school where he was nurtured in the free setting

and a particular teacher tried to play with him as far as possible. He became attached to the teacher, did not avoid eye contact and often laughed at the person. He was diagnosed autistic by a pediatric neurologist at 2;3.

Their teachers and parents are advised, and assessment of the children continues.

Procedures

H.O. was observed from 2;0 to 2;9, 3;6 and 3;8 at a playroom of our clinic and at 3;5, 3;11 and 4;5 at the day care center.

N.N. was observed from 1;8 to 2;1 at home, and at 4;1 he was observed at the nursery school.

(1)Play

At the playroom of our clinic, the child played freely with his mother or the author using toys provided at playroom. These included, a sand box, a trampolin, a slide, water, a piano, toy vehicles, etc.

At home, the day care center or nursery school, the child

played freely with his mother or his teacher using a set of toys and materials.

Toys and materials were as follows:

Meal utensils (two cups, a plate, two spoons, a fork, miniature fruits, two miniature cups, a bottle, a miniature bottle).

Dressing items (a mirror, a comb, a hairbrush, a toothbrush, miniature toilet goods, a miniature hair brush).

Bathing utensils (a washbowl, a soap case, a sponge, a washcloth).

The play objects were six blocks of $6cm^3$ with animal paintings, ten red blocks of $2cm^3$, a truck with string, a toy trumpet, a small ball and a large ball, a doll and doll's dresses, a stuffed panda, animal toys made of rubber, and two rattles.

Play was at least 15 minutes in duration. All of the children's behavior during the observation time was recorded on videotape.

(2) Cognitive tasks

At the playroom of our clinic, home, the day care center or

the nursery school, the children were tested with the tasks listed in TABLE 1.

They were means-ends, causality which Miller, Chapman, Branston & Reichle (1980) used, some combinatorial tasks, drawing and the memory tasks which were selected from Kyoto Scale of Psychological Development(Shimazu, Ikuzawa & Nakase, 1980).

Data analysis

Data was analysed through study of videotapes, to which mothers' and teachers' reports were added.

Verbal Behavior

The number of different utterances which were used in contexts where they appear to be appropriate, the number of different imitated utterances (immediate echolalia), the number of different inappropriate utterances (delayed echolalia), the number of communicative vocalizations, the number of noncommunicative vocalizations and total of vocalizations and utterances were counted for 45 minutes in each session. It was difficult to distinguish between

imitated (inappropriate) utterances and immediate (delayed) echolalia, and so imitated (inappropriate) utterances were included in immediate (delayed) echolalia.

The time of the emergence of referential word, nominal word, immediate echolalia and delayed echolalia was clarified through observations and reports.

Gestural behavior

Frequency of occurence of crane (using the adult's hand as if it were a machine to achieve a purpose), pointing, giving, showing and other gestures was counted for 45 minutes in each session. The meaning of gestures and whether they accompanied vocalizations and looking at the adult or not, was also checked.

Play

Symbolic play from children's spontaneous behavior during play situation with a set of toys or with toys provided at play room of our clinic during 15 minute periods was noted and classified according to the categories presented TABLE 2. Combinatorial symbolic play was counted doubly, as it was divided into acts and each act was classified by category.

The time of emergence of each category was clarified through observations, and mothers' and teachers' reports.

Cognitive task

The responses to each cognitive task listed in TABLE 1 were noted through study of videotapes.

The data at 2;1, 2;9, 3;5 and 3;11 for H.O. and 1;8, 1;11, 2;1, and 4;1 for N.N. were analysed.

Results

(1) Verbal and gestural behavior

Frequency of occurence of each verbal behavior and gestural behavior is shown TABLE 3, TABLE 4 for H.O., and TABLE 5, TABLE 6 for N.N.. Time of emergence of each verbal behavior and gestural behavior from mother's and teacher's report, and observation is shown in FIG. 1 for H.O. and FIG. 2 for N.N..

First the development of verbal and gestural behavior for H.O. will be examined. When he visited our clinic for

the first time (2;0), his mother reported he had uttered manma, nyannyan, taitai. At the observation session he did not utter any meaningful utterance which matched the context till 3;6. At 2;4 of the observation session, he produced immediate echolalia (achi[hot], ara) and delayed echolalia (sazi sazi [spoon]). His mother reported he uttered itai[ouch], tatan [mother], shite [do] at 2;2 and manma[food], sazi(delayed echolalia) and kaki, ashi (immediate echolalia)at 2;4. When he entered the day care center, he said mama looking for his mother. According to his teacher's report, he produced immediate echolalia (itai) at 2;9, sang a part of song at 3;2, and produced delayed echolalia (akarui national) at 3;5. He had a few word by 3;6 but they were almost all echolalia.

At the observation session, a large change occured at 3;6. He uttered bubu while he was moving a car, and the names of numbers on seeing the shapes. He produced immediate echolalia (kisha, kinnikuman etc.), delayed echolalia (superman, petanko) and sang songs. According to his teacher's report, at 3;7 he said koinobori when he saw a sticker of a carp streamer and shampoo when he picked up a bar of soap in his

hand. It is supposed that around 3;7 appropriate nominal words emerged. At 3;8 he uttered five different words excluding numbers. He said tote requesting the toy on the shelf. At 3;11 he pointed to the pictures one after the other with his thumb and continued to say the names of foods by himself or made the adult say the names of the pictures. When the adult did not say them, he looked up at the adult's face. He raised the phone receiver in the proximity of his ear and said moshimoshi ○○○○ desu [Hello! This is ○○○○ speaking]. He uttered word-chains (corn no osenbei [corn cracker], pandonachu [doughnut bread]), for the first time. There were nine utterances (thirteen words), eight immediate echolalia and seven delayed echolalia at 3;11. At 4;5 he was asked the name of pictures, and he answered. He pointed to the numbers of a calendar with his index finger and uttered the names of the numbers without looking at the adult. There were thirty one utterances, eleven numbers, eleven immediate echolalia and eight delayed echolalia. His teacher reports delayed echolalia has decreased since 4;2.

The frequency of noncommunicative vocalizations was greater than that of communicative vocalizations (TABLE 3).

His communicative vocalizations expressed rejection and request. After 3;6 when the appropriate words emerged at observation session, echolalia, the total of vocalizations and utterances increased (TABLE 3).

Concerning gestural bahavior (TABLE 4), H.O. used the adult's hand as if it were a crane, or made giving gesture with regulatory function at the observation session. These gestures did not accompany vocalizations and looking at the adult.

At 3;8 showing gestures while looking at the adult, and giving gestures with interactional function accompanying vocalization, were observed for the first time. After 3;11 crane gestures sometimes accompanied vocalizations and looking at the adult. As mentioned before, the pointing gestures with thumb finger at 3;11 and the pointing with index finger at 4;5 were observed.

As for N.N. he uttered two words(<u>wanwan</u> [dog], <u>nenne</u> [he wants to sleep]) at 1;11 of observation session. Except for that, no word was observed. His mother reported two words

(manma, iya [no]) at 1;4, two words (nenne, manma [food]) at 1:9, three words (nenne, manma, tatan [mother]) at 1;11, and one word (iya) at 2;1. Though he was not observed from 2;1 to 4;1, at 3;2 he uttered nenne at nap time according to the report of his nursery school teacher. He moved to another nursery school at 3;11 where he was nurtured at the free setting, and one teacher interacted with him. He became attached to his teacher. Concerning language development, he uttered manma to see the food, and imitated pan with gesture requesting bread.

Total vocalization was very low for N.N. through all periods (TABLE 5). The proportation of communicative and noncommunicative vocalizations varied at each session. His communicative vocalizations expressed anger, pleasure and request. For gestural behavior (TABLE 6), he used an adult's hand or made giving gesture without vocalization and without looking at the adult's face at all observation sessions to achieve his purpose. At 1;9 and 1;11 he produced a giving gesture with interactional function which did not accompany vocalization and looking at adult. His mother reported that he extended

his hand in the direction where he wanted to go, and he took his mother's hand and made her point to a picture at 2;0. At 4;1 he gave an another child a toy while looking and laughing at her. His teacher reported he pointed to the gate to have her open it while looking at her face at 4;2.

(2) Symbolic play

Frequency of occurence of symbolic play at each observation session is shown in TABLE 7 for H.O. and TABLE 8 for N.N.. Time of emergence of subcategory of symbolic play is displayed in FIG. 1 for H.O.. H.O. had already manipulated materials according to their appropriate and conventional usage (enactive naming act) at 2;0 of his first observation. He used the shovel to dip up sand, raised a phone receiver to his ear and drove a toy train. At 3;5 he began pretend self-play once (he touched a spoon to his mouth and pretended to eat). From 2;0 to 2;9, and at 3;6 and 3;8 he was observed at a playroom where he could play with whatever he wanted, and a set of toys and materials were not prepared. If a set of toys and materials had been prepared at 3;6 and 3;8, symbolic play might have

been elicited. At 3;11 he pretended self-play seven times (he pretended to drink milk from a baby-bottle; he pretended to eat a replica of sushi). He combed the doll's hair or brushed the doll's teeth when he was asked to by the teacher. He substituted the battery of video recorder for a water supply, brought a cup there and pretended to drink from the cup. Substitution play, combinatorial symbolic play and pretend doll-play on demand emerged at the observation session of 3;11. His teacher reported he substituted a toy with a belt for an escalator at 3;7 and substituted blocks for the bar of the entrance to a parking place and said irashaimase chushaken o otorikudasai (delayed echolalia)[Welcome! Please take the parking ticket]. At the observation session of 4;5 he substituted a block for food, picked it up with a spoon and pretended to eat it. After that, he was asked to give it to a stuffed panda, and he did. He pretended to sleep in a blanket and extended this scheme to a stuffed panda. At 4;5 spontaneous pretend doll-play emerged.

N.N. had already manipulated materials according to their

appropriate and conventional usage at 1;4 (he brushed his teeth, he touched a cup to his mouth). At 1;11 he began to pretend self-play (he stirred in a cup with a spoon touched the spoon to his mouth and pretended to eat) and pretend other-play once (he stirred in a cup with a spoon and touched the spoon to his mother's mouth). At 2;1 he repeated pretend self-play with same pattern as that of 1;11. When he was asked to give the doll the baby-bottle after modelling, he engaged in pretend doll-play once. Pretend self-play at 1;11 and 2;1 showed lack of playfulness. At 4;1 he was observed in the room of nursery school, moved around and was not interested in a toy set. When he was asked after modelling, he gave a baby-bottle to a doll twice.

(3) Cognitive tasks

Cognitive ability of autistic children was difficult to assess reliably because their readiness to perform varies and they were not motivated by the activities and toys that were attractive to normal children. The results of cognitive tasks are shown in TABLE 9 for H.O. and in TABLE 10 for N.N..

At 2;1 H.O. slid test materials from a slide and it was difficult to complete the test. At 2;9 H.O. passed the task of Piaget's sensorimotor VI stage of means-ends, nested five containers inside one another, completed three reversed formboards, and made horizontal scribbles. At 3;5 H.O. made circular scribbles, passed the memory task of two cups, VI stage of causality and matched five forms. At 3;11 H.O.drew horizontal and vertical lines. Concerning memory tasks, he played with test materials and so was not assessed.

Next, at 1;8 N.N. opened a box halfway (entry into VI stage of means-ends), nested five containers inside one another, completed three reversed formboards, scribbled, recognized the position of winding a mechanical toy but could not wind (entry into VI stage of causality) and completed the memory task of two cups. At 1;11 he passed VI stage of means-ends, matched five forms, but failed in the two cups memory task. At 2;1 he passed VI stage of causality, but failed in two cups. He imitated the procedure of two cups memory task using cups. His drawing remained scribbles.

At 4;1 he passed the three cups memory task.

(4) Correspondences between language development and symbolic play

Time of emergence of verbal and gestural behavior, and symbolic play is displayed FIG. 1 for H.O., and FIG. 2 for N.N.. Frequency of spontaneous symbolic play and different appropriate utterances excluding numbers for H.O. at each session is displayed in FIG. 3. He had a few semi-referential words and manipulated the object according to their usage at 2;0. Till 3;5 symbolic play was not observed and verbal behavior consisted of a few words which matched context, immediate echolalia and delayed echolalia. At 3;7 appropriate nominal words emerged according to his teacher's report, and substitution play was observed around the same time in daily life. At 3;8 showing and giving gestures with interactional function were observed. At 3;11 when word-chains, vocabulary spurt and pointing gestures were observed, combinatorial symbolic play with multischeme and pretend doll-play on demand emerged.

For N.N. a few referential words which developed from

babbling were observed and reported from 1;8 to 4;1, but words did not increase. At 1;11 pretend self-play and pretend other-play were observed, and at 2;1 pretend doll-play after asking and modelling was observed.

(5) Correspondences between language development and cognitive ability

At 3;5 before nominal words emerged, H.O. passed the memory task of two cups and made circular scribbles. At 3;11 with vocabulary spurt and the onset of word-chains, H.O. drew horizontal and vertical lines.

From 1;8 to 4;1 the speech of N.N. did not vary. At 4;1 before pointing gesture emerged, he drew circular scribbles and passed the three cups memory task.

Disscussion

One boy (H.O.) acquired speech, but it was three kinds of speech--appropriate utterance which mathched the context, immediate echolalia and delayed echolalia. Interactional

gestures with vocalizations and looking at adult were emerging, and total of vocalizations and utterances increased. Another child (N.N.) did not develop speech, but pointing gesture have emerged recently.

The relationships between early language, symbolic play, sensorimotor skills and social development on the basis of a longitudinal study of two autistic boys, will be discussed. Temporal correspondences between early language developmant and symbolic play were found in the case of H.O.. The emergence of nominal words corresponded to the onset of substitution play, and word-chains co-occured with the onset of combinatorial symbolic play. Immediate echolalia and delayed echolalia were not related to symbolic play. According to Takagi (1976), delayed echolalia is not used in symbolic level.

N.N. engaged in pretend self-play and pretend other-play but did not perform substitution play. For N.N. only a few words, which developed from babbling, were observed.

In normal children, the emergence of substitution play corresponds to the onset of vocabulary spurt (Ogura, 1987).

The present study was consistent with the result of normal children. Casby & Ruder (1983) reported symbolic play which involves the use of one object to represent another (substitution play) was found to be a strong correlate of early language development. According to Morehead & Morehead (1974), true representation begins with symbolic play, and representation, and in symbolic play, is seen as an essential ingredient for the development of language. Here, symbolic play implies the representation of an absent object and/or make-believe representation: the child substitutes objects or events (signifiers) for other objects or events (the signified).

H.O. began to construct the relationship between a "signifier" and a "signified" in language and play around 3;7.

McCune-Nicolich (1981) predict that if language and symbolic play both reflect the development of underlying symbolic ability, then these processes can be expected to develop in parallel, with transitions to more advanced levels occuring close in time. In autistic children the hypothesis of McCune-Nicolich was supported.

Next the importance of social interactions in symbol formation will be discussed. Normal infants ordinarily develop selective bonds or attachments to particular people some time around 6-9 months of age . Infants readily engage in social interchanges, and it is meaningful and appropriate to talk about 'dialogues' between parent and infant (Rutter, 1983). Autistic children do not develop attachments to particular persons unless a careful approach is made.

In the present study a particular person played with H.O. and he became attached to her, showing gestures with looking at her, and a giving gesture with interactional function accompanying vocalizations were observed. Around this time, the development of symbolic ability was observed in play and language. When N.N. began to attach to his mother, pretend self-play and a few referential words were observed. But after he entered the regular nursery school, the environment of nursery school was too severe for him, and the development of language and play stopped. He moved to another nursery school where the atmosphere was warm and free, and began to attach to a particular teacher. An autistic child is very

sensitive to the person and the atmosphere. If he is approached warmly and his play is shared, he becomes attached to a particular person.

Around the emergence of pretend self-play, normal children enjoy interaction with an adult in play, the frequency of giving gestures with interactional function increases, and jargon emerges (Ogura, 1985a, 1985b). They communicate with jargon and protolanguage, and discover the relationship between sound, and the events or objects in the world. They establish a "language set" of using the sound to express the world (Okamoto, 1982). Children learn the meanings of sounds and objects in social interactions. Werner & Kaplan (1963) emphasize the essential social basis of symbolization in addressor-addresee.

Concerning sensorimotor skills, the two autistic boys passed VI stage of means-ends and causality test, performed discriminating forms test and nested containers inside one another even though they had few words. So it appears these sensorimotor skills are not related to early language development.

TABLE 5 Frequency of occurence of each verbal behavior in N.N.

Verbal behavior \ Age	1;8	1;9	1;11	2;1	4;1
Different words	0	0	2	0	0
Communicative vocalizations	1	12	8	16	6
Noncommunicative vocalizations	5	9	13	4	17
Total of vocalizations and words	6	21	23	20	23

Both boys were deficient in memory task and drawing. They were not interested in the memory task and may not have comprehended the instructions. The present memory task is similar to the object permanence task which Corrigan (1978) used. It is not certain whether they were deficient in memory (object permanence) or not. H.O. passed the two cups memory task and made circular scribbles at 3;5 when pretend self-play emerged, and at 3;11 when substitution and combinatorial symbolic play emerged, he drew horizontal and vertical lines. N.N. failed in the two cups memory task and did not make circular scribbles at 1;11 when pretend self-play emerged. Drawing may be related to symbolic play and language development. Piaget & Inhelder (1969) pointed out that around the second year of life semiotic function, which was manifested in deferred imitation, symbolic play, drawing, imagery and language, emerges. The relationship between early language development and object permanence needs to be investigated further.

Sigman & Ungerer (1984) hypothesized that representational thought may be manifested in two different systems. One system,

reflected in the development of sensorimotor skills, may involve the capacity to recall information that then is accessible for problem solving. The capacity to translate experience into language and play symbols that are manipulated independently may reflect a second system. It is in the second system, the ability to form and manipulate symbols, that autistic children may have a major impairment. The cognitive deficits seen in autistic children are secondary to their impaired social development. All the areas of specific cognitive deficit identified depend on social interaction for their development. Symbolic and social development in young children are necessarily intertwined.

The present study indicated that the two autistic children were deficient in symbolic function which included language, symbolic play and drawing, but when H.O. attached to a paticular adult, the development of language, symbolic play and drawing was observed.

The follow-up study of N.N. will clarify the relationship between symbolic function and social development.

The hypothesis of Sigman & Ungerer (1984) is supported by the present study.

The analysis of the content of social interactions for two autistic children needs to be investigated further.

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TABLE 1 Cognitive tasks

Tasks	Items		
Means-Ends	IV stage	Moves to object out of reach	
	V stage	Uses string to get object	
	VI stage	Opens the chocolate box by himself	
Causality	IV stage	Pushes away an interfering hand	
	V stage	Gets adult to activate mechanical toy	
	VI stage	Discovers how to activate mechanical toy	
Combinatorial Tasks	Discrimination of forms	Reverse Matching	Completes three reversed formboards Matches five forms(circular, triangle, square, halfcircle, cross)
	Nesting containers	Three	Nests three containers inside one another
		Five	Nests five containers inside one another
Memory	Wrapping	Finds a toy car wrapped in a cloth	
	Two cups	Finds a toy which is hidden under either A or B, and then the position is reversed	
	Three cups	Finds a toy hidden under one of three cups after the situation was screened for five seconds	
Drawing	Scribbles	Scribbles spontaneously	
	Horizontal scribbles	Makes horizontal scribbles	
	Circular scribbles	Makes circular scribbles	
	Horizontal and vertical lines	Draws horizontal and vertical lines	

TABLE 2 Category of symbolic play

Category		Abbreviation	Definition	Example
Pretend self-play		PSP	Pretense behavior directed toward self	pretends to drink pretends to wash
Pretend other-play		(To other person)POP (To doll)PDP	Pretense behavior directed toward other person Pretense behavior directed toward doll	feeds mother with a spoon feeds doll with a spoon
Substitution play		SP	Using materials as a substitute for other objects	substitutes blocks for a train
Combinatorial symbolic play	Combinations of single scheme	CSP	Repetition of a single pretense act to a series of agents or patients	drinks from a bottle and then brings it to doll's mouth as if to feed them
	Multischeme combinations		Linking together differnt pretense schemes	stirs in a cup with a spoon and then drinks from the cup
	Combinations of single scheme and multischeme		Repetition of multischeme combinations to a series of agents or patients	stirs in a cup with a spoon, then drinks from the cup and brings it to doll's mouth as if to feed them

TABLE 3 Frequency of occurence of each verbal behavior in H.O.

Verbal behavior \ Age	2;0	2;1	2;2	2;4	2;6	2;9	3;5	3;6	3;8	3;11	4;5
Different appropriate utterances	0	0	0	0	0	0	0	1(6) N	5(14)	9	31(42)
Different immediate echolalia	0	0	0	2	0	1	0	5	8	8	11
Different delayed echolalia	0	0	0	1	0	0	0	2	8	7	8
Communicative vocalizations	1	5	5	4	15	1	1	2	0	1	11
Noncommunicative vocalizations	3	8	34	8	6	46	4	55	77	19	29
Total of vocalizations and utterances	4	13	39	15	21	48	5	78	182	105	136

N: ( ) indicates the frequency including the name of numbers.

TABLE 4 Frequency of occurence of each gesture in H.O.

Gesture \ Age	2;0	2;1	2;2	2;4	2;6	2;9	3;5	3;6	3;8	3;11	4;5
Crane	1	0	3	0	1	3	2	1	3	4	12
Pointing	0	0	0	0	0	0	0	0	0	91	20
Giving	1	2	1	3	0	2	0	0	1 I	0	1 I
Showing	0	0	0	0	0	0	0	0	9	0	1
Other gestures	0	0	0	2	0	2	0	2	0	1	3

I: indicates frequency of giving gesture with interactional function
(Other giving gestures have regulatory function.)

TABLE 6 Frequency of occurence of each gesture in N.N.

Gesture \ Age	1;8	1;9	1;11	2;1	4;1
Crane	1	0	0	9	1
Pointing	0	0	0	0	0
Showing	0	0	3	0	0
Giving	10	2(1)[I]	1[I]	3	1[I]
Other gestures	2	2	4	0	4

I: indicates frequency of giving gesture with interactional function.
(Other giving gestures have regulatory function.)

TABLE 7 Frequency of occurence of symbolic play in H.O.

Symbolic play \ Age	2;0~2;9	3;5	3;6	3;8	3;11	4;5
Pretend self-play	0	1	0	0	7	20(1) D
Pretend other-play	0	0	0	0	(5) D	3(6) D
Substitution play	0	0	0	0	2	11
Combinatorial symbolic play	0	0	0	0	2	2

D: ( ) indicates the occurence on demand.

TABLE 8 Frequency of occurence of symbolic play in N.N.

Symbolic play \ Age	1;8	1;9	1;11	2;1	4;1
Pretend self-play	0	0	7	22	0
Pretend other-play	0	0	1(Adult)	MD 1	MD 2
Substitution	0	0	0	0	0
Combinatorial symbolic play	0	0	0	0	0

MD: indicates modelling and demand.

TABLE 9 Responses to cognitive tasks in H.O.

Cognitive tasks \ Age		2;1	2;9	3;5	3;11
Means-Ends		IV stage	VI stage	VI stage	VI stage
Causality		IV stage	?[a]	VI stage	VI stage
Combinatorial tasks	Discrimination of forms	Reverse	Reverse	Five forms	Five forms
	Nesting containers	?	Five	Three	Five
Memory		?	Wrapping	Two cups	?
Drawing		?	Horizontal scribbles	Circular scribbles	Horizontal and vertical lines

a: ? indicates the task could not be examined.

TABLE 10 Responses to cognitive tasks in N.N.

Cognitive tasks \ Age		1;8	1;11	2;1	4;1
Means-Ends		Entry into VI stage	VI stage	VI stage	VI stage
Causality		Entry into VI stage	Entry into VI stage	VI stage	VI stage
Combinatorial tasks	Discrimination of forms	Reverse	Five forms	Three forms	Reverse
	Nesting containers	Five	Three	Five	Five
Memory		Two cups	Failed in two and three cups	Imitated the procedure	Three cups
Drawing		Scribbles	Scribbles	Scribbles	Circular scribbles

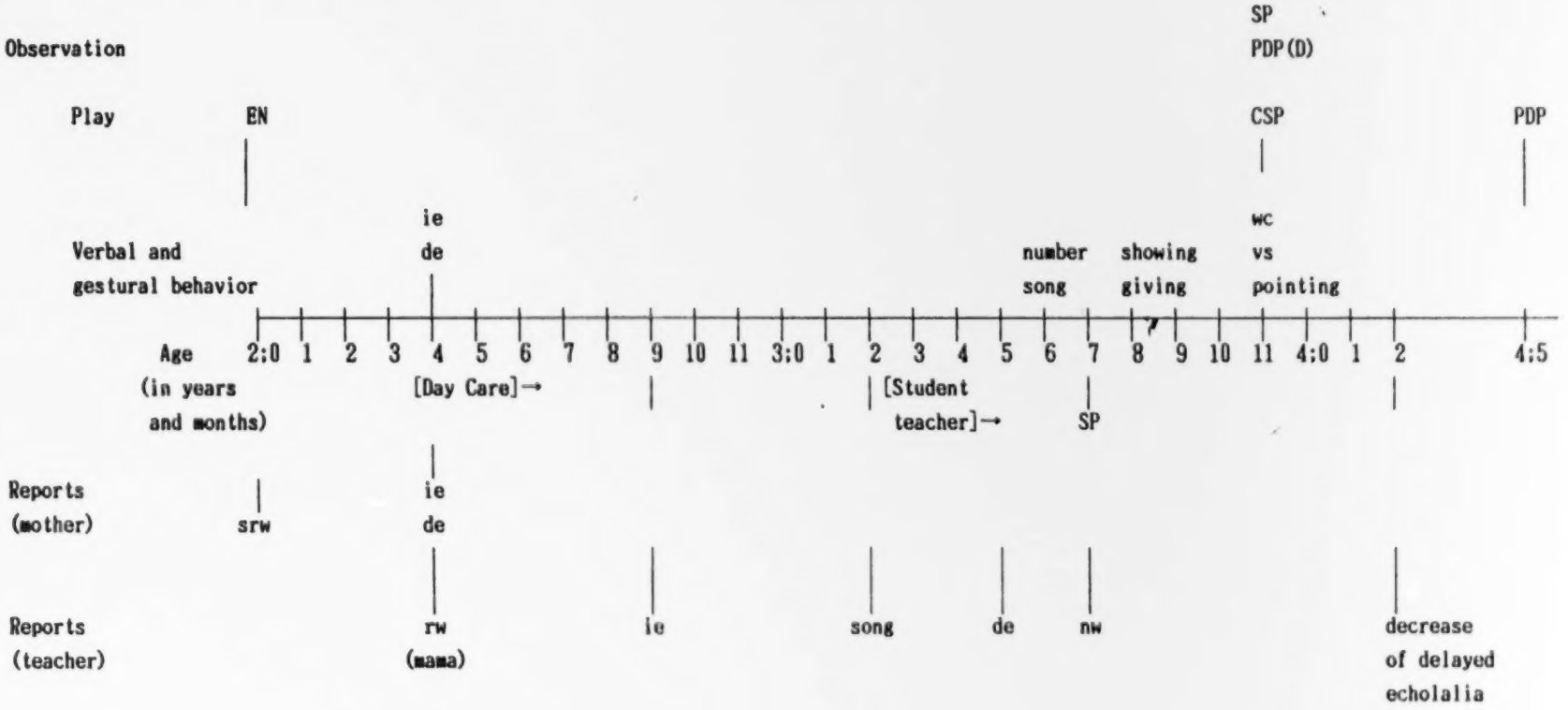

FIG. 1 Time of emergence of verbal and gestural behavior, and play in H.O.

ie= immediate echolalia
de= delayed echolalia
srw= semi-referential word
rw= referential word
nw= nominal word
wc= word-chains
vs= vocabulary spurt

EN= Enactive naming
PS= Pretend self-play
PDP(D)= Pretend doll-play(on demand)
SP= Substitution play
CSP= Combinatorial symbolic play

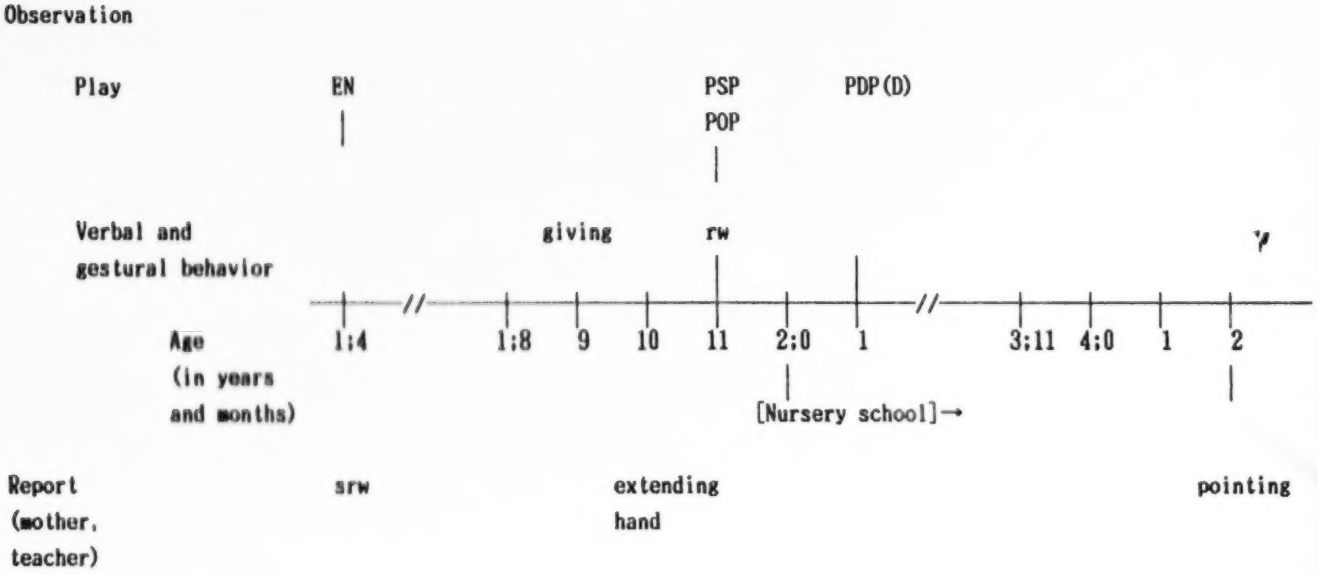

Fig. 2 Time of emergence of verbal and gestural behavior, and play in N.N.

srw= semi-referential word
rw= referential word
En= Enactive naming
PSP= Pretend self-play
POP= Pretend other-play
PDP(D)= Pretend doll-play on demand

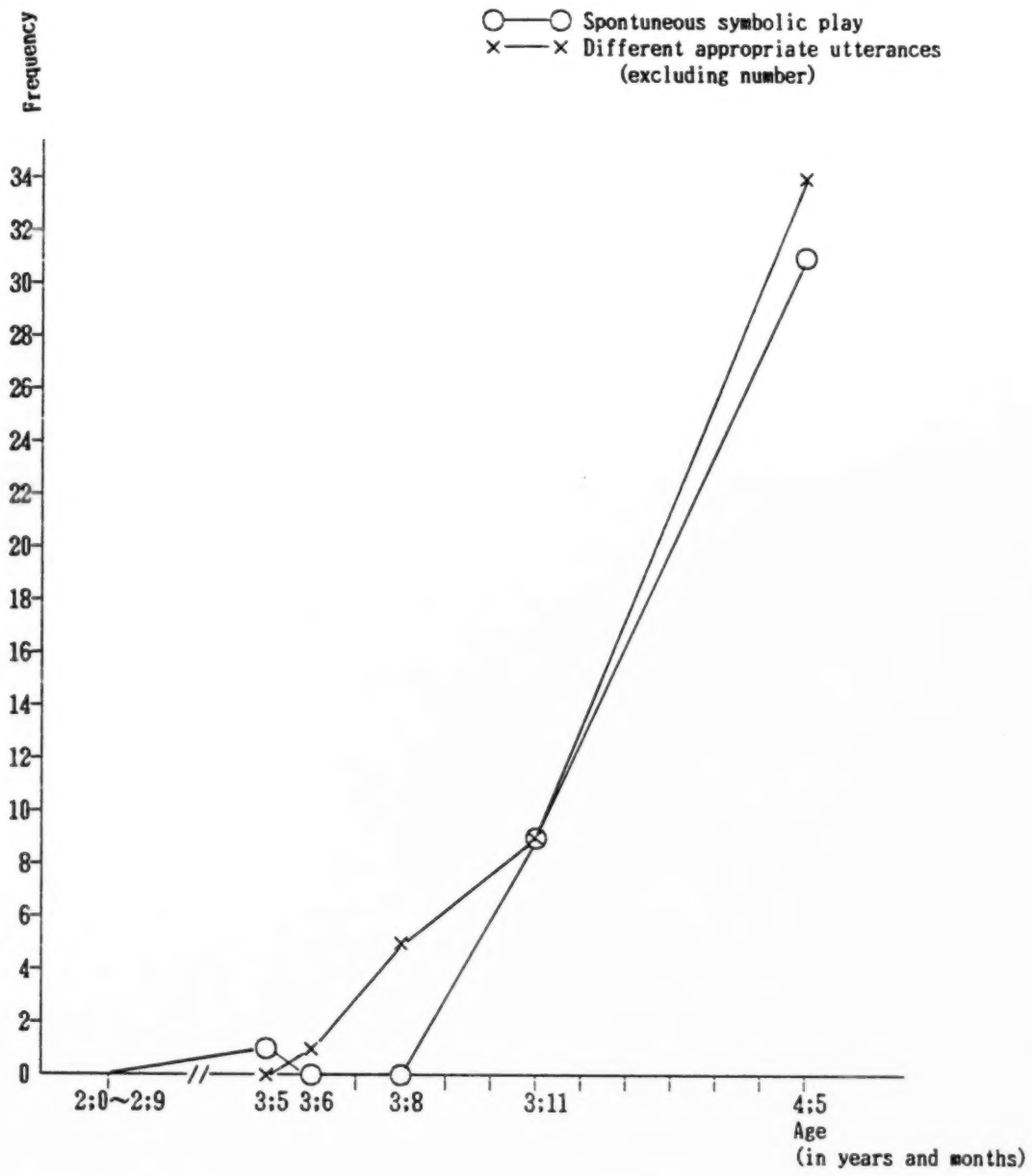

FIG. 3 Frequency of spontaneous symbolic play and different appropriate utterances for H.O.